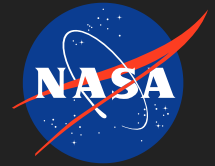


## NDE for Ablative Thermal Protection Systems, Phase I

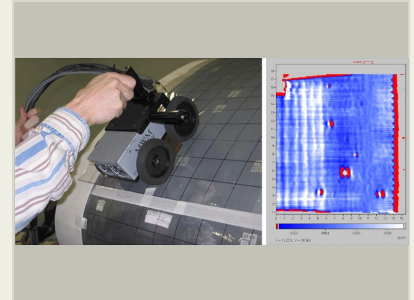
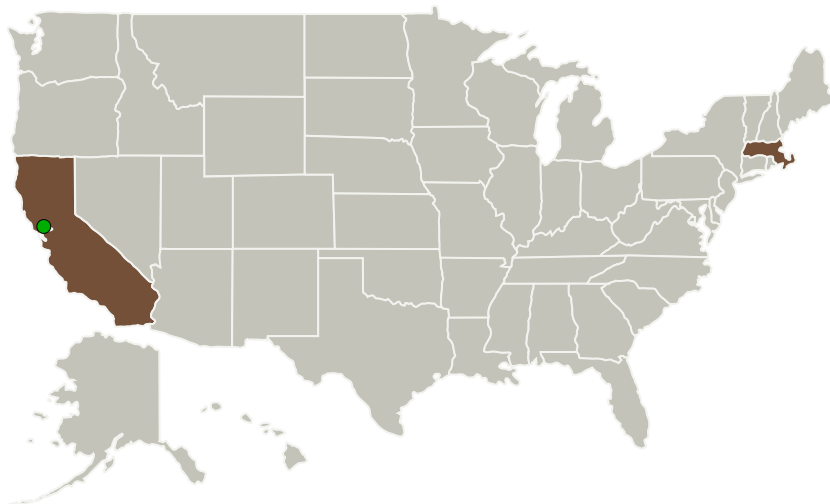
Completed Technology Project (2013 - 2013)



## Project Introduction

This program addresses the need for non-destructive evaluation (NDE) methods for quality assessment and defect evaluation of thermal protection systems (TPS), including permanently installed sensors for TPS condition, stress and temperature monitoring. Novel linear drive eddy current methods are proposed for NDE of carbon-based TPS materials, such as three dimensional woven fiber composites and felts. Using a combination of physics-based models, multivariate inverse methods, high resolution imaging, and innovative sensor array constructs the developed methods will independently monitor the material characteristics of interest. In Phase I, the focus is on enhancing and adapting methods developed for carbon-based composite structures and laminates and demonstrating feasibility of these enhanced methods for three-dimensional woven composites and felts. JENTEK's physics-based methods for diagnostics of layered media using MWM-Array technologies, including an eddy current micromechanical model extension for composites, have been demonstrated for condition stress and temperature monitoring. MWM-Arrays have a linear drive that permits both scanning type imaging and permanent installation for monitoring of anisotropic properties, temperature, and stresses at multiple depths. The projected depth of the magnetic field into the test material can be adjusted through the sensor dimensions and excitation frequencies; this enables inspection of materials more than 1.0-in. thick and supports measuring far-side surface recession in ablator materials. JENTEK delivered the MWM-Array solution used by NASA KSC on the Space Shuttle Leading Edge to detect damage of the Reinforced Carbon-Carbon (RCC) thermal protection tiles; thus JENTEK is well-positioned to deliver a practical TPS NDE solution.

## Primary U.S. Work Locations and Key Partners



NDE for Ablative Thermal Protection Systems

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## NDE for Ablative Thermal Protection Systems, Phase I

Completed Technology Project (2013 - 2013)



Organizations Performing Work	Role	Type	Location
JENTEK Sensors, Inc.	Lead Organization	Industry	Waltham, Massachusetts
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

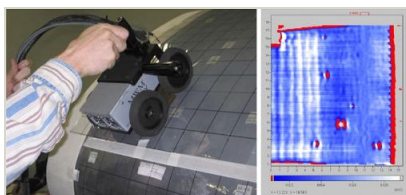
Primary U.S. Work Locations	
California	Massachusetts

## Project Transitions

**May 2013:** Project Start**November 2013:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/140412>)

## Images

**Project Image**

NDE for Ablative Thermal Protection Systems  
(<https://techport.nasa.gov/image/133774>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

JENTEK Sensors, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Andrew Washabaugh

**Co-Investigator:**

Andrew Washabaugh

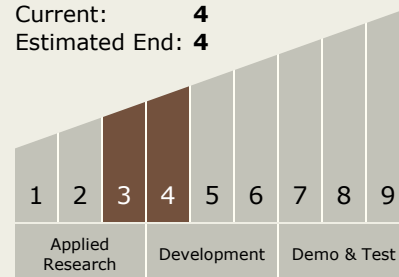
# NDE for Ablative Thermal Protection Systems, Phase I

Completed Technology Project (2013 - 2013)



## Technology Maturity (TRL)

Start: **3**  
Current: **4**  
Estimated End: **4**



## Technology Areas

### Primary:

- TX09 Entry, Descent, and Landing
  - └ TX09.4 Vehicle Systems
    - └ TX09.4.6 Instrumentation and Health Monitoring for EDL

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System